

**METHOD AND SYSTEM FOR PEER-TO-PEER COMMUNICATION MANAGEMENT IN
WIRELESS COMMUNICATION NETWORKS**

BACKGROUND OF THE INVENTION

5 The invention relates generally to wireless communication systems, and more particularly to method and system for peer-to-peer (P2P) communication management in wireless communication networks.

P2P communication between two mobile terminals provides a direct link between the two mobile terminals in public land mobile network. P2P
10 communication is particularly appropriate when two users are camping on one cell and close to each other. When the direct link is established, the dedicated links between the base station and mobile terminals can be disconnected, while the common control channel (CCCH) is maintained. This saves two radio channels for the system and reduces the end-to-end delay. In
15 addition, the P2P communication allows for an increase in the system communication capacity because of less transmission power by the mobile terminals within a limited P2P supported radio range. Furthermore, the battery power consumption in the mobile terminals in P2P communication is also saved. Therefore, P2P communication should be highly encouraged as a
20 value-added service.

Among existing 3G systems, the TDD CDMA system is the most suitable system for the application of peer-to-peer communication, because the same carrier frequency is used in both uplink and downlink communications, which will simplify the RF module of the mobile terminal. Additionally, the application 5 of peer-to-peer communication technology will overcome some inherent shortcomings of the TDD CDMA system, such as the shortage of spreading code, small coverage, etc. An example of the TDD CDMA system is the TD-SCDMA system, which has gained more popularity in China.

Rapid deployment of P2P communication services, however, has not yet 10 occurred. One of the main reasons is the lack of an effective scheme for managing the P2P communication services in wireless communication networks.

Therefore, there is a need for an effective scheme for managing the P2P communication services for promoting P2P communications.

SUMMARY OF THE INVENTION

The present invention provides an effective scheme for managing P2P communications between mobile terminals.

According to one embodiment of the invention, a wireless communication system capable of managing peer-to-peer (P2P) communications is provided. In this embodiment, upon receiving a request from a mobile terminal for initiating a call to another mobile terminal, the system determines whether P2P communication can be established between the two mobile terminals. This may be accomplished by determining whether both mobile terminals have subscribed P2P communication services, and if they have, whether both mobile terminals are suitable for using the P2P communication services. The system also determines an operating mode of the two mobile terminals for P2P communication. If the P2P communication can be established between the two mobile terminals and both mobile terminals are in a default mode for P2P communication, the system establishes P2P communication between the two mobile terminals.

On the other hand, in the above embodiment of the invention, if one of the mobile terminals is in a prompt mode, the system sends a prompt to the mobile terminal in the prompt mode, along with information about incentives for using P2P communication services. If the user of the mobile terminal in the

prompt mode selects the P2P communication services, the system allocates resources for setting up a P2P link between the two mobile terminals. After the P2P communication between the two mobile terminals is completed, the system records information relating to P2P communication services in at least 5 one of a home location register and a visitor location register, and sends discounted billing information to the mobile terminals.

Other objects and attainments together with a fuller understanding of the invention will become apparent and appreciated by referring to the following description and claims taken in conjunction with the accompanying 10 drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is explained in further detail, and by way of example, with reference to the accompanying drawings wherein:

FIG. 1 shows an overview of P2P communication in a wireless communication network, according to one embodiment of the invention; and

FIG. 2 illustrates a process performed by a wireless communication system (e.g., UTRAN) for managing P2P communication, according to one embodiment of the invention.

Throughout the drawings, the same reference numerals indicate similar or corresponding features or functions.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 shows an overview of P2P communication in a wireless communication network (e.g., a Universal Terrestrial Radio Access Network (UTRAN) and a 3GPP core network), according to one embodiment of the invention. The UTRAN comprises a radio network controller (RNC) 10 responsible for radio resource allocation and management and a Node B 16, which is a base station transceiver. The UTRAN is connected to a 3GPP core network (CN) 20, which is responsible for high layer signaling and data interaction. Home Location Register (HLR) and Visitor Location Register (VLR) 26 typically located in CN 20 are responsible for recording information about mobile users and related services.

In the embodiment shown FIG. 1, non-dedicated control channels between Node B 16 and mobile terminals (e.g., UE1 and UE2) still exist, while the traffic channels exist only between the UEs. Thus, the wireless communication network can control the P2P communications, e.g., for billing purposes. A more detailed description of this type of P2P communication is disclosed, for example, in a co-pending patent application entitled "Method and System for Establishing Peer-to-Peer Communications in Wireless Communication Networks," filed by Koninklijke Philips Electronics N.V., on March 7, 2003, Attorney's Docket No. CN030003, Application Serial No. _____, the disclosures of which are hereby incorporated by reference.

In FIG. 1, after receiving a request from a mobile terminal (UE1 or UE2) for originating a call to another mobile terminal, the UTRAN will check whether the two UEs have subscribed the P2P communication services. If both UEs have subscribed the P2P communication services, the UTRAN will help them, if feasible, to establish the P2P communication link, and provide the UEs with the discount information about the P2P communication services. The users have a choice of whether to take the advantage of the P2P communication services. If both the users decide to use the P2P communication services, they will pay only a fraction of the normal charges as an incentive. A detailed process for managing the P2P communication by the UTRAN is described below in conjunction with FIG. 2.

FIG. 2 illustrates a process 100 performed by a UTRAN for managing P2P communication, according to one embodiment of the invention. The various steps of process 100 are preferably implemented with software modules.

After a user has switched on a UE, the UE searches in a cell for signals from the UTRAN, via a Broadcasting Control Channel (BCCH). The UTRAN will receive updated registration information from the UE (step S102). If the user has already subscribed the P2P communication services, the user can set (or preset) an operating mode for the P2P communication services as either a default mode or a prompt mode. In the default mode, the P2P communication services are automatically selected as a first choice for

communication when the UE originates or receives a call. In the prompt mode, however, the UE will receive a prompt from the UTRAN for selecting the P2P communication services whenever the UE originates or receives a call. Each of the two modes can be set for a specific time duration.

- 5 When the UE originates a call, it first sends a request to the UTRAN to initiate the call. The request may include a P2P connect request. After receiving the request to originate the call (step S106), the UTRAN may also automatically attempt to set up a P2P communication link between the originating and receiving UEs, regardless of whether there is a P2P connect
10 request from the UE. The UTRAN will first check whether both UEs have subscribed the P2P communication services (step S108). Then, the UTRAN determines whether both UEs are suitable for using the P2P communication services (step S112). If any one of the UEs is not suitable because of, for example, the UEs are not within a P2P communication supported radio range,
15 the UTRAN will provide the conventional communication services to the UEs (step 114).

- On the other hand, if both UEs are suitable for using the P2P communication services, the UTRAN will determine whether the UEs have selected a default or prompt mode for the P2P communication services (step
20 S116). If the prompt mode is selected for a UE, the UTRAN sends a prompt to the UE, along with information about the incentive to encourage the user to

select the P2P communication services (step S122). The incentive may be in the form of a discount, a rebate or promotional coupons. The discount may be calculated based on the statistical benefits resulting from the system capacity increase and the overall interference decrease in one cell. The 5 discount rate may also vary in accordance with the actual traffic load conditions or the interference in one cell during a predetermined time duration. For example, if the traffic load is very heavy, the discount rate for the P2P communication services may be higher. Furthermore, users engaging in data services through a P2P link may be rewarded with special discounts.

10 After the UTRAN receives a selection from the UE (step S126), it determines whether the UE has selected the P2P communication services (step S132). If at least one of the UEs fails to select the P2P communication services because of the QoS (Quality of Service) concerns in the case of an important call for example, the UTRAN will provide the UEs with the conventional 15 communication services (step S114). On the other hand, if both UEs have selected the P2P communication services or both UEs have selected the default mode for using the P2P communication services, the UTRAN will allocate resources for establishing the P2P link between the two UEs (step S136). The UEs then performs the three steps as outlined in FIG. 2. Specifically, the UEs 20 will probe the P2P link (step S141) to determine whether the P2P link is available (step S141). If the P2P link is not available, the UTRAN will take back the P2P communication resources (step S152) and then provide the conventional

communication services to the UEs (step S114). If the P2P link is available, however, the UEs will start the P2P communication (step S154).

After the P2P communication is completed and the P2P communication resources are released, the UTRAN records the information relating to the P2P
5 communication services in a Home Location Register (HLR) or a Visitor Location Register (VLR) (step S154), and sends the discounted billing information to the UEs to allow the users to immediately view the related charges (step S162).

In the above, the invention has been illustrated in conjunction with a UTRAN system. However, it is not limited to this system. In fact, any wireless
10 communication system may be used in conjunction with the present invention.

While the invention has been described in conjunction with specific embodiments, it is evident that many alternatives, modifications and variations will be apparent to those skilled in the art in light of the foregoing description. Accordingly, it is intended to embrace all such alternatives, modifications and
15 variations as fall within the spirit and scope of the appended claims.